REMARKS/ARGUMENTS

Minor changes are made to this specification. Claims 26 is amended. Claims 1-3, 5-6, 8-10, 13-14, and 17-26 are pending in the application. Reexamination and reconsideration of the application, as amended, are respectfully requested.

Claim Rejections—35 U.S.C. § 112, Second paragraph

Claim 26 stands rejected under 35 U.S.C. § 112, second paragraph as being indefinite for failing to particularly point and distinctly claim the subject matter applicant regards as the invention. Specifically, the Office contends that there is insufficient antecedent basis for the limitations "the center of the substrate," "the center line of the electrodes" and "the center lines of the areas." Claim 26 is amended. Applicant believes that all claim terms in amended claim 26 have sufficient antecedent basis and are clear. Withdrawal of the rejection is respectfully requested.

Claim Rejections—35 U.S.C. § 103

Claim 1-3, 5-6, 8-10, 13 and 26 stand rejected under 35 U.S.C. § 103(a) as being obvious over Fujii et al (U.S. Patent Publ. 2003/0178057, hereinafter "Fujii") in view of Hanoka et al. (U.S. Patent 5,476,553, hereinafter "Hanoka") and Fukawa et al. (U.S. 2004/0200522, hereinafter "Fukawa"). Claim 26 is amended. Applicant respectfully traverses the rejection.

> A group of solar cell elements comprising:
> a plurality of solar cell elements and at least three wiring members for electrically interconnecting adjacent solar cell elements, each solar cell element comprising:
> a substrate comprising a front surface and a rear surface; and
> a front surface electrode on the front surface; and
> a rear surface electrode on the rear surface; and

wherein the front surface electrode comprises at least three front surface bus bar electrodes and a plurality of finger electrodes;

wherein at least one of the plurality of finger electrodes is connected to two or more of the at least three front surface bus bar electrodes,

wherein the rear surface electrode comprises at least three rear surface bus bar electrodes,

wherein the at least three wiring members electrically interconnect the at least three front surface bus bar electrodes of a first adjacent solar cell element to the at least three rear surface bus bar electrodes of a second adjacent solar cell element, and

wherein each of the at least three front surface bus bar electrodes has a width of not less than 0.5 mm and not more than 2 mm, and each of the finger electrodes has a width of not less than 0.05 mm and not more than 0.1 mm.

Applicant respectfully submits that the combined references cannot render the present invention obvious at least because a group of solar cell element having a "front surface electrode [that] comprises at least three front surface bus bar electrodes and a plurality of finger electrodes" "wherein each of the at least three front surface bus bar electrodes has a width of not less than 0.5 mm and not more than 2 mm, and each of the finger electrodes has a width of not less than 0.05 mm and not more than 0.1 mm" would not have been obvious to a person of ordinary skill in the art at the time the invention was made.

Regarding Fujii, the Office admits that "Fujii is silent as to the type of surface electrode." (Office Action, at p. 3.) Regarding Hanoka et al., the office cites Hanoka et al. Fig. 2 as disclosing "the surface electrode is generally in the form of a grid comprising a plurality of bus bars..." (Office Action, at p. 6). However, the office also admits that Hanoka does not "explicitly" disclose three bus bars. (Office Action, p.3) Applicant has carefully reviewed Hanoka et al. and agrees that nothing in Figure 2 or in the accompanying description describes as solar cell having a

"front surface electrode [that] comprises at least three front surface bus bar electrodes and a plurality of finger electrodes" as required by amended claim 1. The two bus bar electrode design is explicitly described as the "conventional solar cell 20 of a kind utilized in making modules..." (Hanoka, col. 6, lines 8-10)

In connection with Applicant's previous response, Applicant submitted the data which is attached hereto as Attachment "A" to show the present invention exhibited unexpectedly superior results over the prior art. On November 17, 2011, Examiner Bourne and Lawrence McClure conducted an interview in which the results of Attachment "A" were discussed. The Office indicated that the unexpected results of Attachment "A" would be persuasive in overcoming the rejection if the results were further substantiated by including more data, including with respect to the number of bus bars, and the widths of the bus bars and the finger electrodes. This additional data is attached hereto as Attachment B. The additional data show results for solar cells and modules having 1, 2, 3 and 4 bus bars and for widths of the finger electrodes and bus bar electrodes spanning the entire claimed range. Applicant respectfully submits that the combined data of Attachments A and B support a finding of unexpected results, and as such applicant respectfully submits that the claims should be allowed.

One aspect of the present invention is the finding that a solar cell element having a "front surface electrode [that] comprises at least three front surface bus bar electrodes and a plurality of finger electrodes" has unexpected positive effects on a group of solar cell elements or a module comprised of the individual elements. As described at para. [0045], U.S. Patent Publ. 2007/0295381 (hereinafter, the '381 Publ.):

> "...while in the case of two bus bar electrodes, when the widths of the finger electrodes are narrowed for preventing light energy loss at

> the light receiving surfaces of the solar cell elements, the fill factor FF tends to deteriorate due to the series resistance component in the finger electrodes, providing three bus bar electrodes allows the lengths of the finger electrodes to be shortened, so that deterioration of the fill factor FF due to the series resistance component of the finger electrodes can be suppressed. A solar cell module with high output characteristics and high efficiency can therefore be obtained."

In short, one aspect of the present invention is that, when assembling individual solar cells into solar cell modules, the deterioration of the Fill Factor (FF) can be suppressed by increasing the number of bus bar electrodes. None of the cited art either teaches or suggests that the fill factor can be suppressed by having at least 3 bus bar electrodes as is in the claimed invention. As is made clear by MPEP 2144.05, a particular parameter must first be recognized as a result-effective variable, i.e., a variable which achieves a recognized result, before the determination of the optimum or workable ranges of said variable might be characterized as routine experimentation. The failure of the prior art to recognize the "suppression effect" on the fill factor as described in the present invention weighs heavily in favor of patentability of the present invention.

Several important data points from Attachment A and Attachment B are as follows:

Number of Bus Bars	FF	Eff(%)	Avg. Pmax [W]
2(as single cell)	0.770	16.986	4.134
2 (in module)	0.702	15.214	3.702
3 (as single cell)	0.776	16.875	4.107
3 (in module)	0.725	15.525	3.778
4 (as single cell)	0.782	16.8	4.081
4 (in module)	0.737	15.7	3.824

As can be seen from this data, **individual solar cell elements** having 2 bus bar electrodes are **more efficient and produce more power** (16.986, 4.134 respectively) than individual solar cells having 3 bus bar electrodes (16.875, 4.107) or 4 bus bar electrodes (16.8, 4.081). Suprisingly however, **solar cell modules** made made up of 2 bus bar cells **are less efficient and produce less power** (15.214, 3.702, respectively) than solar cell modules made of 3 bus bar cells (15.525, 3.778) and solar cell modules made of 4 bus bar cells (15.7, 3.824). More concretely, one unexpected and surprising and unexpected result that flows from this "suppression effect" individual **solar cell elements** having 2 front surface bus bar electrodes have a **higher** the conversion efficiency (Eff[%] =16.986) and output characteristics (Pmax[W]=4.134) than individual solar cell elements having 3 front surface bus bar electrodes (Eff[%] =16.875, Pmax[W]=4.107) or 4 front surface bus bar electrodes. Conversely, solar cell modules (that is a group of solar cell elements) made of elements having 2 front surface bus bar electrodes have a **lower** conversion efficiency (Eff[%] =15.214) and output characteristics (Pmax[W]=3.702) than do solar cell modules of elements having 3 front surface bus bar electrodes (Eff[%] =15.525, Pmax[W]=3.778) or 4 bus bar electrodes.. This leads to the unexpected result that a higher efficiency module can be made of solar cell elements having 3 front surface bus bar electrodes each of which are individually less efficient than solar cell elements which have 2 front surface bus bar electrodes.

As shown in Attachment B, the "suppression effect" described in Applicant's specification is shown across the entire claimed range. All of these results are significant.

It is respectfully submitted that the application is in condition for allowance. Reexamination and reconsideration of the application, as amended, are requested.

If for any reason the Examiner finds the application other than in condition for allowance, the Examiner is requested to call the undersigned attorney at the Los

Angeles, California telephone number (310) 595-3107 to discuss the steps necessary for placing the application in condition for allowance.

If there are any fees due in connection with the filing of this response, please charge the fees to our Deposit Account No. 07-1896.

Respectfully submitted,
DLA PIPER LLP (US)

Date: March 21, 2012

By: _____
Lawrence J. McClure
Registration No. 44,228
Attorney for Applicant(s)

2000 Avenue of the Stars
Suite 400 North Tower
Los Angeles, California 90067
Telephone: 310-595-3000
Facsimile: 310-595-3300

Attachment A

solar cell

number of front surface bus bar electrode	n. (number of solar cell)	Avg. / Isc[A]	Avg. / Jsc[mA/cm2]	Avg. / Voc[V]	Avg. / FF[-]	Avg. / Eff[%]	Avg. / Pmax[W]
2	24	8.687	35.698	0.618	0.770	16.986	4.134
3	24	8.575	35.238	0.617	0.776	16.875	4.107

solar cell module

number of front surface bus bar electrode	n. (number of solar cell module)	Avg. / Isc[A]	Avg. / Jsc[mA/cm2]	Avg. / Voc[V]	Avg. / FF[-]	Avg. / Eff[%]	Avg. / Pmax[W]
2	5	8.553	35.147	0.616	0.702	15.214	3.702
3	5	8.465	34.786	0.615	0.725	15.525	3.778

condition

	width (mm)
front surface bus bar electrode	1.67
finger electrode	0.09

substrate: 156 mm * 156 mm

Attachment B

Single Cell or Module	Number of Front Surface Bus Bar Electrodes	Number of Cells/Modules	Width of Front Surface Bus Bar Electrodes (mm)	Width of Finger Electrodes (mm)	Substrate (mm x mm)	Av. / Isc[A]	Avg. / Jsc[mA/cm2]	Avg. / Voc[V]	Avg. / FF[-]	Avg. / Eff[%]	Avg. / Pmax[W]
Single Cell	1	24	1.67	0.09	156 x 156		See Note 1	See Note 1	See Note 1	See Note 1	See Note 1
Single Cell	4	24	1.67	0.09	156 x 156	8.481	34.850	0.616	0.782	16.8	4.081
Module	1	5	1.67	0.09	156 x 156		See Note 1	See Note 1	See Note 1		See Note 1
Module	4	5	1.67	0.09	156 x 156	8.426	34.623	0.616	0.737	15.7	3.824
Single Cell	2	24	0.5	0.05	156 x 156	8.813	36.214	0.622	0.581	13.1	3.185
Single Cell	3	24	0.5	0.05	156 x 156	8.854	36.383	0.622	0.695	15.7	3.829
Module	2	5	0.5	0.05	156 x 156	8.697	35.736	0.617	0.490	10.8	2.627
Module	3	5	0.5	0.05	156 x 156	8.758	35.986	0.616	0.626	13.9	3.379
Single Cell	2	*12	2	0.1	156 x 156	8.681	35.672	0.621	0.778	17.2	4.197
Single Cell	3	*13	2	0.1	156 x 156	8.542	35.101	0.620	0.784	17.1	4.154
Module	2	5	2	0.1	156 x 156	8.538	35.085	0.617	0.700	15.1	3.686
Module	3	5	2	0.1	156 x 156	8.401	34.521	0.616	0.727	15.5	3.762

*The number is reduced due to the occurrence of technical problem

Note 1 : Not measured because resistance was high and Fill Factor is thought to be extremely low.